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Assessment

Development of a novel coding scheme (SABICS) to record nurse–child interactive behaviours in a community dental preventive intervention

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ABSTRACT

Objective: To develop and validate the St Andrews Behavioural Interaction Coding Scheme (SABICS): a tool to record nurse–child interactive behaviours.
Methods: The SABICS was developed primarily from observation of video recorded interactions; and refined through an iterative process of applying the scheme to new data sets. Its practical applicability was assessed via implementation of the scheme on specialised behavioural coding software. Reliability was calculated using Cohen's Kappa. Discriminant validity was assessed using logistic regression.
Results: The SABICS contains 48 codes. Fifty-five nurse–child interactions were successfully coded through administering the scheme on The Observer XT8.0 system. Two visualization results of interaction patterns demonstrated the scheme's capability of capturing complex interaction processes. Cohen's Kappa was 0.66 (inter-coder) and 0.88 and 0.78 (two intra-coders). The frequency of nurse behaviours, such as "instruction" ($OR = 1.32$, $p = 0.027$) and "praise" ($OR = 2.04$, $p = 0.027$), predicted a child receiving the intervention.
Conclusions: The SABICS is a unique system to record interactions between dental nurses and 3–5 years old children. It records and displays complex nurse–child interactive behaviours. It is easily administered and demonstrates reasonable psychometric properties.
Practice implications: The SABICS has potential for other paediatric settings. Its development procedure may be helpful for other similar coding scheme development.

1. Introduction

The significance of effective communication between paediatric dental staff and child patients has been widely acknowledged [1]. Effective communication is often associated with a patient-centred interaction approach in general healthcare communication, where a provider is encouraged to be aware of individual patients' needs and to recognize their emotions [2–4]. A child-centred approach that recognizes and addresses a child's needs and emotions will require additional elements for delivering effective communication. This is because young children are prone to dental anxiety [5] and a considerable amount of staff attention during communication is naturally directed to the management of child anxiety.

Therefore, the key definitive features of effective communication in paediatric dentistry should, at least, include those staff behaviours that reduce anxiety and bring about cooperation-related behaviours in children. These behaviours can be acquired by staff either through formal training or vicariously through daily practice. The effects of some routine clinical behaviour in reducing child dental anxiety have been recognized; their significance has, however, not been fully appreciated. The authors of a recent systematic review [6] called for further investigation to identify those behaviours that have consistent effects on child cooperation in routine practice. In particular, they urged development of sophisticated and valid behavioural codes to measure those behaviours.

The assessment of healthcare communication between dental staff and child patients has been attempted using various methods, such as rating scales (e.g., the behavioural profile rating scale [7]), checklists (e.g., the child behavioural problem checklist [8]) and coding instrument (e.g., Weinstein et al. [9]). An influential interaction behaviour coding instrument is Weinstein et al.'s coding scheme [9]. It was initially developed to support their pilot finding that certain dentist's behaviours affected child behaviour. Thus both dentist and child behaviour were included in the same scheme. In the modified scheme [10,11], child's fear-related behaviours were clearly distinguished from non-fear-related ones.

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This coding scheme was potentially appropriate for our study because it included interactive behavioural codes for both dental professionals (including dental assistants) and children as young as three to five years old. This enabled analysis of the relationship between staff and child behaviours. Our study context was, however, quite specific: dental nurses using individual motivational strategies to encourage children to accept the fluoride varnish application in a nursery school setting. We were primarily searching for a coding scheme that could reflect a focus on dental staff's encouragement-centred interaction approach that supports the effective communication in paediatric dentistry; and at the same time a scheme that would enable inclusion of novel behavioural codes that are specific to a clinical context (fluoride varnish application) and communication content (with nursery-school children).

We decided to develop a new coding scheme incorporating some behavioural categories from Weinstein et al.'s [9] work and adopting their data-based bottom-up approach to generate initial behavioural codes. We believe this coding scheme is the first to record an interaction process between dental nurses and young children in a community setting.

Our overall aim is to report the development of the coding scheme. Our objectives are: (1) to describe the development of the St Andrews Behavioural Interaction Coding Scheme (SABICS) to record nurse-child interactive behaviours; and (2) to provide empirical validation for the coding scheme proposed with our data in a community preventive dental intervention.

2. Methods

2.1. The study context

The fluoride varnish application, a dental preventive intervention, is an important part of a National Health Service (NHS) initiative in Scotland known as Childsmile [12–14] to help improve the oral health of children. This intervention was delivered by specially trained dental nurses. They worked in pairs, with one nurse taking the lead role of applying the fluoride varnish onto the teeth of 3–5 year-old children at nursery schools. These nurses received training on fluoride varnish implementation but not specifically on child management skills. From initial discussions with service managers a small but significant proportion (up to 1 in 5) of children refused or were reluctant to accept the varnish application. In field work, these nurses exhibited a variety of unique encouragement styles in persuading a child's compliance. Supported by empirical evidence [6], we believe that the way dental nurses interact with young children plays an important role in the delivery outcome. In order to investigate the interaction, the first step was to develop a detailed interactive behavioural coding scheme.

2.2. Video recording

In order to capture both verbal and non-verbal aspects of communication, real-time video recording was used to investigate nurse-child interactions. This study describing the development of this new scheme is part of a more extensive programme to research community oral health initiatives. A power analysis justified that our sample size of over 450 video-taped applications allowed us to detect a moderate effect of nurse behaviours in predicting unsuccessful applications when 20% of application attempts were estimated to be unsuccessful. Recordings took place in 35 nursery schools across three NHS health board regions in Scotland, ensuring heterogeneity of children and nurse encouragement strategies. Although a possible bias in data collection was that child/nurse behaviours might be altered by video recording, the empirical evidence [15,16] reassured us that it was acceptable to study healthcare communication involving children using this video recording method.

2.3. Ethical approval

Participants provided written consent, assuring confidentiality, to take part in the study. The study has been independently reviewed by the Tayside Committee on Medical Research Ethics B, Scotland UK (approval number: 09/S1402/22).

2.4. Development of the SABICS

The SABICS was constructed over 18 months by our research team in two stages: (i) development, and (ii) refinement. In the development stage, ten team meetings were held throughout the 12-month pilot period to discuss behavioural code definition and to select relevant behaviours from field observations and the literature. The main research question (i.e., how do nurses encourage children to cooperate?) led us to attend to nurse behaviour especially. The coding scheme was designed to be sensitive to detect child's response to nurse behaviour. Some dentist's common behaviours in Weinstein's coding scheme [9] that were applicable to our study, were retained, such as "instruction", "information-giving" and "praise". We developed a scheme that not only focussed on nurses' encouragement strategy and children's response but also on the specifics of the dental context (fluoride application protocol) and the interaction content (e.g., nurses using a fantasy statement). Adopting Weinstein et al.'s [9] approach, an initial list of behaviours was generated from observation of ten video clips over a period of one week. The initial scheme was then applied to new sets of video data captured during the pilot stage. During this iterative process, codes were modified, operational definitions were clarified and typical examples compiled.

In the refinement stage, the iterative process continued for about six months following the completion of the data collection in the main study. Sixteen video tapes including a range of duration and outcomes of nurse–child interactions from various NHS boards and nurse pairs were selected from 456 video tapes to test the coding scheme applicability. Clarification of ambiguous codes was achieved based on code applicability, literature evidence, research questions and team consensus. Our extensive data set and the detailed inspection of this material reassured the development team that we had included all relevant behaviour for our scheme. The details of the SABICS (Table 2) are described in the results section.

2.5. Participants

For the current study, two groups of participants (Table 1) were included for different purposes: to evaluate applicability and reliability of the coding scheme, and to assess the scheme's discriminant validity.

For applicability and reliability testing, we selected 55 children (3–5 years old) from successful applications, who were not routine in their receipt of the fluoride varnish application (i.e., initially anxious and/or uncooperative during the procedure). Staff participants were 19 female dental nurses from three NHS health board regions, who delivered the fluoride varnish application for these children. Our field observation and coding experience showed that nurses spend more time and effort persuading these non-routine children receiving the application successfully. We believed that conducting detailed coding on these more extensive interactions will test the scheme's capability of capturing complex behaviours.

Table 1
Summary of participants.

Purpose	Child participant	Nurse participant
To evaluate applicability and reliability of the scheme	55 non-routine successful children: 3–5 yrs, 27 boys, 26 nurseries	19 female dental nurses: 25–56 yrs, 3 NHS regions (NHS Fife, ForthValley & Tayside)
To assess scheme's discriminant validity	36 initially anxious children (8 refusals): 3–5 yrs, 22 boys, 14 nurseries	6 female dental nurses: 25–56 yrs, NHS Fife

For discriminant validity assessment, we chose a group of children (28 successful applications and 8 refused applications) who were homogeneous in their initial behavioural presentation (i.e., all initially anxious and not immediately cooperative). The fluoride varnish applications were delivered by six female nurses from NHS Fife only. This was intended to reduce possible effects of some nuisance variables (e.g., difference between health boards) on the varnish outcome.

2.6. Coding procedure

The coding procedure was implemented on The Observer XT 8.0 system [17]. The Observer is a registered trademark of Noldus Information Technology. A total of 55 interactions were coded in six weeks by two researchers (Y.Z., G.F.). For each interaction, coding was conducted in the following three steps:

(1) Enter user-defined variables

Participant and application-related information, for example, child's gender and application position, was entered into the system, usually at the beginning of each coding.

(2) Watch the interaction to decide what to code first

In order to get an overall feeling of the range of behaviours exhibited in the interaction, we watched the entire interaction before any coding commenced. This enabled us to decide on whom (lead nurse, support nurse or child) and what behaviour (verbal, non-verbal or protocol behaviour) to code first. As interactions were complex, this procedure enabled concentrating on one individual's behaviour at a time to improve coding accuracy.

(3) Code interactive behaviours

Using the computer keyboard, behaviours were coded and recorded in the event log in The Observer XT8.0 system. We focused on one person (e.g., child) and one type of behaviour (e.g., verbal) at each coding. Completion of coding a typical interaction required us to go through the video clip a maximum of seven times (i.e., lead verbal, lead non-verbal, support verbal, support non-verbal, child verbal, child non-verbal and protocol).

2.7. Inter- and intra-coder reliability checks

Cohen's Kappa, with 95% confidence interval estimates, was used to check both inter- and intra-coder reliability for the entire coding scheme. Cohen's Kappa (K) is an overall measurement of agreement that is corrected for agreement by chance [18]. We checked agreement on (a) whether a particular behaviour took place; and (b) whether behaviours occurred at a same time. The tolerance window was set to one second. Both inter- and intra-coder reliabilities were checked twice during a 6-week coding period for 55 interactions.

2.8. Discriminant validity assessment

To assess the scheme's discriminant validity between successful and unsuccessful children, we used logistic regression with frequency of certain nurse behaviour as independent variable and successful/unsuccessful application as dependent variable. From 29 nurse behaviours, we selected 11 that occurred most frequently with a mean frequency above five per minute to ensure meaningful and reliable statistical tests. A combination of newly developed behaviour codes (e.g., fantasy statement, permission-seeking and using a sticker as reward) and those pre-existing in the literature (e.g., information-giving, instruction and praise) were also included. We predicted that the frequency of these behaviours (controlling for duration of the interaction) would be associated with successful application. No *a priori* decisions were made to identify which of these behaviours would discriminate more successfully than others. However the expectation was that the two sets of children would demonstrate substantially different profiles of behaviour.

3. Results

3.1. The St Andrews Behavioural Interaction Coding Scheme (SABICS)

The coding scheme manual consists of three components: (1) general rules and guidance; (2) specific codes, operational definitions and examples of codes and (3) implementation guidance. The second component including the actual behavioural codes is presented in Table 2.

General rules. Study background information including the fluoride varnish application and general aims of the study were described. The unit of a single code is an individual meaningful behaviour. Codes were grouped into three categories: nurse behaviour, child behaviour and protocol behaviour. Both verbal and non-verbal behaviours were defined under nurse/child behaviour categories. Child non-verbal behaviours (e.g., "shakes head") were point event codes, where only frequency was counted; all other behaviours were state event codes. All state event behaviours were mutually exclusive (only one behaviour within each category can be scored at any time) and exhaustive (no time can pass without a codable behaviour occurring [19]).

Codes, definitions and examples. The scheme contains 48 codes: 6 protocol codes, 29 and 13 behavioural codes for nurse and child respectively (Table 1). Each behaviour was assigned a code (i.e., two letters) for the purpose of implementing the scheme on The Observer XT8.0 system. Each code was given a clear definition. Operational definitions enable one coder to apply the codes consistently over time (intra-coder reliability) and to help other coders to interpret the codes in the same way (inter-coder reliability). Typical examples were provided for each behavioural code (Table 1 contains one example only).

Implementation guidance. The coding scheme was implemented via specialized software, The Observer XT8.0 system. This system displays the video clip of an interaction and the coding scheme on the same computer screen. When coders identify a behaviour that is described on the coding scheme, they press the key on the computer key board that was associated with the behaviour (e.g., "ps" for "permission seeking"). The Observer XT8.0 system will then register the occurrence of the behaviour in the event log and automatically assign a timestamp. The duration of behaviour was calculated for the elapse of time between the beginnings of two mutually exclusive behaviours.

Table 2
St Andrews Behavioural Interaction Coding Scheme (SABICS).

Behaviour	Code	Operational definition
Protocol		
Introduction/lead in (initial state)	in	Dental nurse (DN) greets child before any procedure starts.
Open mouth check	om	DN examines child's mouth without a dental mirror.
Mirror mouth check	mm	DN examines child's mouth with a dental mirror usually when examining top teeth.
Varnish application	va	Includes brush preparation, tooth drying and varnish application.
All others (protocol)	pa	None of the behaviours in this category occurs.
Stop (point event)	sp	End of varnish application when the last time the brush is removed from the child's mouth. Stop coding after this point.
Verbal Nurse		
Silence (initial state)	sl	
Appeal to authority	aa	DN reminds child of parent or nursery staff's desire for treatment. (Mum has asked us to do it.)
Appeal to example	ae	DN informs child of others who have had treatment. (Other boys and girls all had it done.)
Child's name	cn	DN calls child by name.
Compliment	cp	DN makes positive comments on child's appearance, name etc. not on behaviour (lovely shoes).
Fantasy statement	fs	DN refers to magical, cartoon characters or objects (princess, spiderman teeth).
Humour	hl	DN makes a joke, silly statement, silly question, or exaggeration. (You've got a nosey tongue.)
Information-giving	ig	DN gives child procedure-related information (teeth, instruments, method, outcome).
Information-seeking	is	DN asks child for procedure-related information.
Instruction	st	DN gives child instruction to carry out an action. (Open your mouth wide.)
Negative comment	nc	DN makes negative comment about child's behaviour or attitude.
Negative consequence	nq	DN informs child of negative or lack of positive outcome if no treatment.
Non-procedural talk	nt	DN makes statements or questions not related to procedure. (How old are you?)
Nurse-procedural talk	nu	Procedural talk between nurses or with support worker. (Shall we do the bottom ones only?)
Offer of task alternative	ot	DN offers child a lesser challenge (just counting the teeth).
Permission-seeking	ps	DN consults child for their consent in order for nurse to carry out an action. (Is it OK if I count your teeth?)
Pet name	pn	DN calls child an endearing name (sweetheart).
Positive consequence	pq	DN informs child of positive outcome of treatment.
Praise	pb	DN makes positive comment about child's behaviour or attitude.
Reassurance	re	DN describes ease and pleasantness of treatment, varnish etc. (It's easy peasy.)
Request	rq	DN asks child to carry out an action. (Can you get on the chair please?)
Reward (sticker)	rs	DN promises child a sticker often dependent on behaviour.
Non-verbal Nurse		
All others (initial state)	ao	
Gesture	ge	DN uses gestures to demonstrate instructions (in tell-show-do).
Touch directing	td	DN physically directs or manoeuvres child's body, limbs, head or mouth (lifts child on to a chair).
Touch playful	tp	DN touches child with hands, brush, mirror etc. in a playful manner (tickling, poking, giving high five).
Touch reassuring	tr	DN uses touch to comfort child (patting, stroking, holding child's hand).
Touch restraining	tt	DN physically restricts movement of child's head, body or limbs.
Touch other	to	All other touches (for attention, safety, thanks).
Verbal Child		
Quiet (initial state)	qt	
Crying/groaning	cg	Verbal sound suggesting pain, fear, upset.
Laughter	la	Verbal sound suggesting enjoyment.
Speech (no)	sn	Child says 'no' to refuse treatment-related requests.
Speech (other)	so	Except for 'yes' and 'no', any other utterances by the child.
Speech (yes)	sy	Child says 'yes' to accept treatment-related requests.
Non-verbal Child (point event)		
Hides face/mouth	hf	Child covers face with arms or hands, burying face in adult's body.
Non-verbal agreement	ag	Child conveys acceptance by non-verbal behaviours (nodding head).
Interacts with instrument	te	Child holds or touches the instruments (brush, cotton wool, mirror, gloves).
Pushes away (hand)	ph	Child use hand/s to push DN or instruments away.
Shakes head	sh	Child conveys refusal/reluctance to treatment by shaking head.
Sits up/moves away	su	Child sits up from lying on the dental chair; stands up (walks away) from sitting.
Turns head	th	Child turns head away from DN or a normal position.

3.2. Scheme applicability – implementation in The Observer XT8.0 system

The implementation process of the coding scheme via The Observer XT 8.0 system is visualized in Fig. 1. We can see from Fig. 1 that the video clip, coding scheme, event log with coded behaviours all integrated on one computer screen. Fig. 2 provides an example of an event log in the system that records all coded behaviours (under "Behaviour" column) with corresponding subjects and time stamps. Some typical example of behaviour is also provided in the "Comment" column.

3.3. Inter- and intra-coder reliability

Inter-coder reliability was checked twice at the end of the 2nd week of a 6-week coding period. Two randomly selected clips from each coder's work were coded by both the 1st and 2nd coders to ensure that a satisfactory reliability was achieved before the final coding commenced. The results of each check are described separately.

The first check was on the non-routine child No.1, which was randomly selected from all nine coded interactions from Coder One in the first two weeks. Cohen's Kappa was 0.58, which was acceptable [19]. The main disagreements lay in the definition and implementation of the "silence" code. After discussion, we agreed to code as few "silence" as possible unless the verbal gap was obvious ($\geq$2 s). Another key disagreement arose when multiple behaviours occurred almost simultaneously. For example, when a nurse said "sit on the chair and I am going to count your teeth", both "instruction" and "information-giving" should be coded.

After discussing coding discrepancies, the definitions of codes and coding procedures were clarified and improved. This achieved

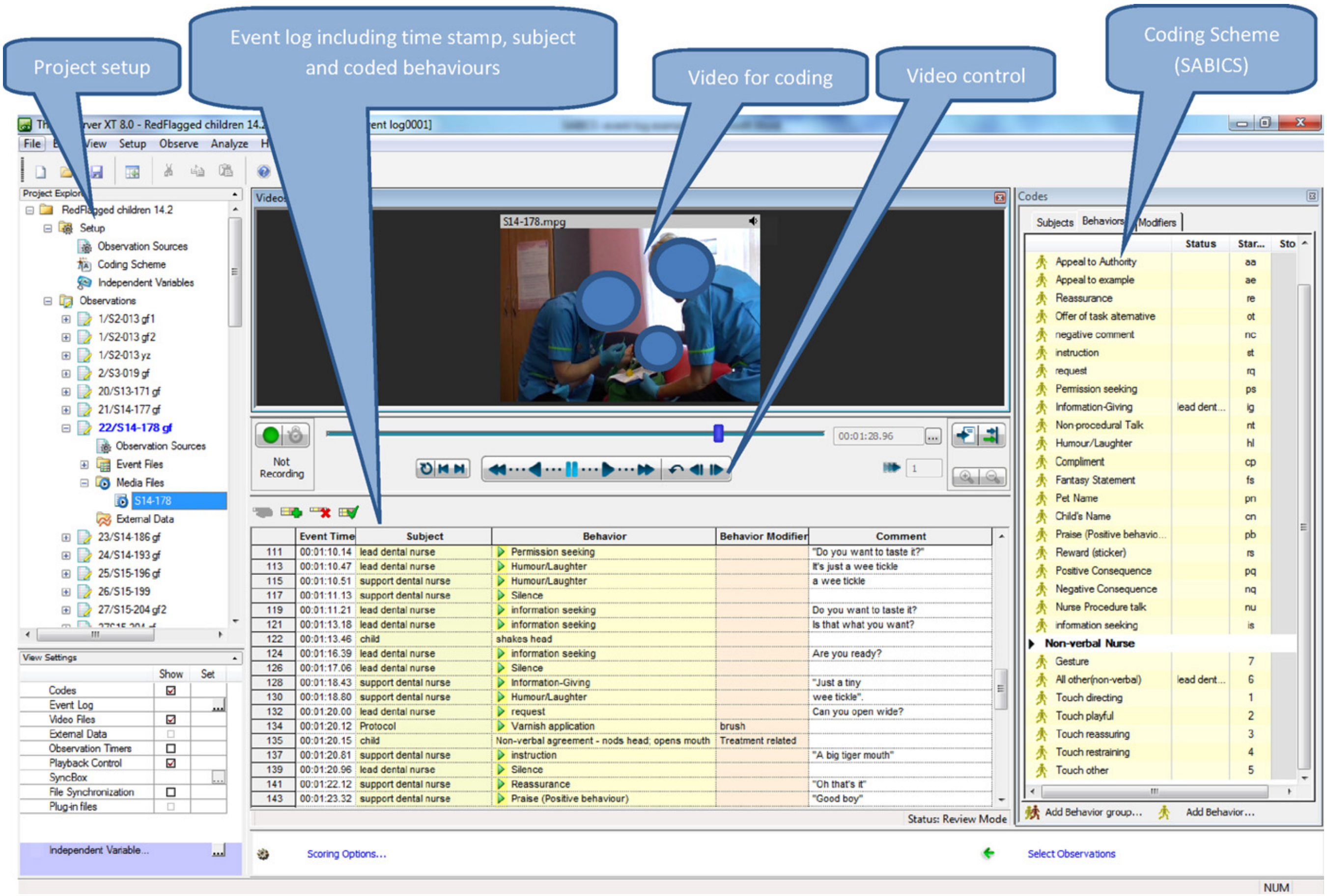
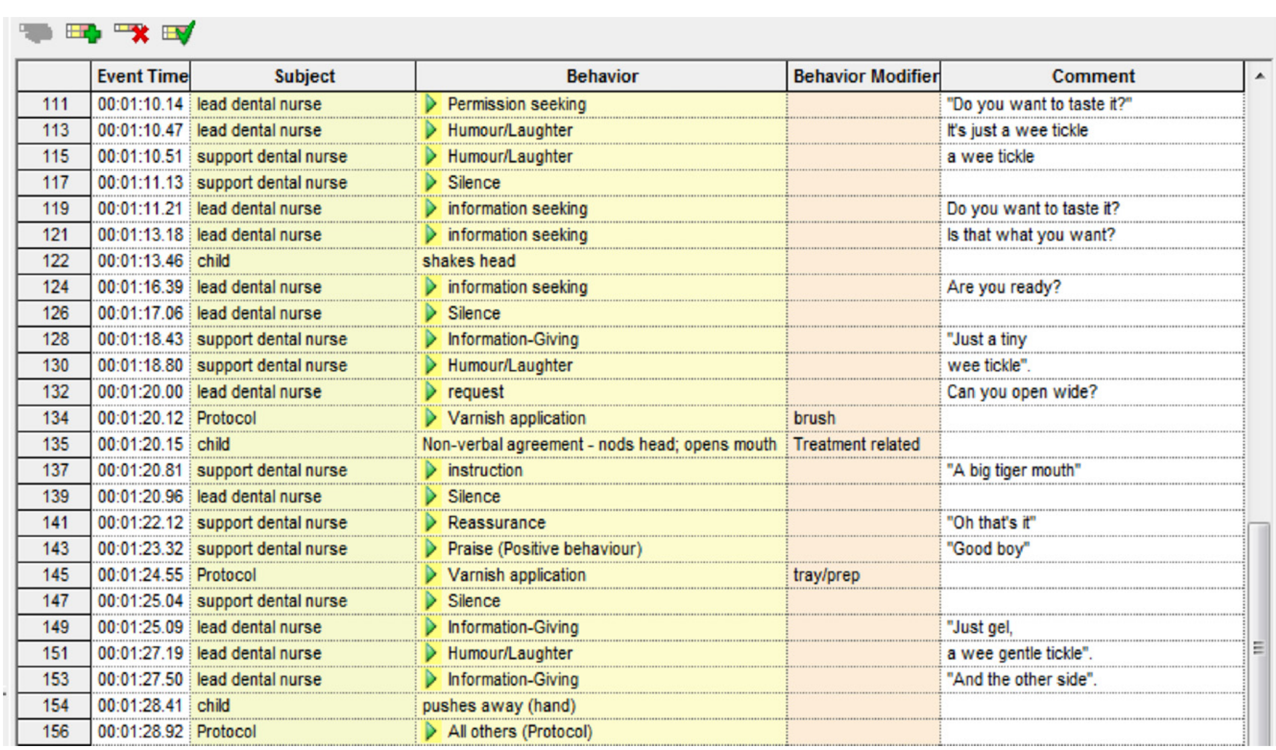


Fig. 1. Visualization of the SABICS scheme implementation process on The Observer XT8.0 system.



	Event Time	Subject	Behavior	Behavior Modifier	Comment
111	00:01:10.14	lead dental nurse	Permission seeking		"Do you want to taste it?"
113	00:01:10.47	lead dental nurse	Humour/Laughter		It's just a wee tickle
115	00:01:10.51	support dental nurse	Humour/Laughter		a wee tickle
117	00:01:11.13	support dental nurse	Silence		
119	00:01:11.21	lead dental nurse	information seeking		Do you want to taste it?
121	00:01:13.18	lead dental nurse	information seeking		Is that what you want?
122	00:01:13.46	child	shakes head		
124	00:01:16.39	lead dental nurse	information seeking		Are you ready?
126	00:01:17.06	lead dental nurse	Silence		
128	00:01:18.43	support dental nurse	Information-Giving		"Just a tiny
130	00:01:18.80	support dental nurse	Humour/Laughter		wee tickle".
132	00:01:20.00	lead dental nurse	request		Can you open wide?
134	00:01:20.12	Protocol	Varnish application	brush	
135	00:01:20.15	child	Non-verbal agreement - nods head; opens mouth	Treatment related	
137	00:01:20.81	support dental nurse	instruction		"A big tiger mouth"
139	00:01:20.96	lead dental nurse	Silence		
141	00:01:22.12	support dental nurse	Reassurance		"Oh that's it"
143	00:01:23.32	support dental nurse	Praise (Positive behaviour)		"Good boy"
145	00:01:24.55	Protocol	Varnish application	tray/prep	
147	00:01:25.04	support dental nurse	Silence		
149	00:01:25.09	lead dental nurse	Information-Giving		"Just gel,
151	00:01:27.19	lead dental nurse	Humour/Laughter		a wee gentle tickle".
153	00:01:27.50	lead dental nurse	Information-Giving		"And the other side".
154	00:01:28.41	child	pushes away (hand)		
156	00:01:28.92	Protocol	All others (Protocol)		

Fig. 2. An example of coded behaviours in an event log in The Observer XT 8.0 system.

Table 3
Results of inter- and intra-coder reliability for 55 non-routine children.

Type	Occasion of check	Cohen's *k* (95% CI)	Agreement (%)
Inter-coder	1st time: Child 1 from Coder 1, end of Week 2	0.58 (0.49, 0.67)	60%
	2nd time: Child 10 from Coder 2, end of Week 2	0.66 (0.57, 0.75)	68%
Intra-coder	1st time: Child 3 from Coder 1, end of Week 4	0.88 (0.82, 0.94)	89%
	2nd time: Child 28 from Coder 2, end of Week 6	0.78 (0.70, 0.86)	79%

a higher inter-coder reliability at the next attempt. A second check took place on the non-routine child No. 10, randomly selected from Coder Two. This time, Cohen's Kappa was 0.66, which was considered satisfactory according to Altman's [19] criteria. Again, disagreements were discussed, further clarifications on definitions and procedures were made; that is, the underlying concepts were refined but not fundamentally changed.

Intra-coder reliability was also checked twice to ensure the internal consistency of the same coder over a period of time. The first check was conducted at the end of Week 4 (completion of 2/3 of the coding) when Coder One re-coded the same Child 3 (initially coded in Week 2). The second check was at the end of Week 6 (end of coding) when Coder Two re-coded Child 28 (initially coded in Week 3). Cohen's Kappa was 0.88 and 0.78 for Coder One and Coder Two respectively. Table 3 summarizes the results of inter- and intra-coder reliability.

3.4. Visualization of interaction process

In order to demonstrate the coding scheme's capability of capturing complex interaction processes, we present visualization results of two different types of interaction patterns between dental nurses and children.

In the first visualization (Fig. 3), the lead dental nurse used a "matter-of-fact" strategy to deal with an initially anxious boy. She employed a minimal number of behaviour types; mainly giving treatment-related information (e.g., "I am going to look at your teeth with this special mirror") and instructing the child to carry out actions (e.g., "open your mouth please"). Both the support nurse and the child exhibited least possible involvement. The entire interaction lasted for only 2 min and 29 s from nurse's attention to the child to the completion of the varnish application (mean duration = 3:36 in m:s).

The second interaction (Fig. 4) of 9 min and 41 s showed a lengthy "coaxing" style of persuasion strategy to encourage a confident boy. We can see from Fig. 3 that, because of limited child's positive response to an initial encouragement from the support nurse, the lead nurse took over the persuasion task with extensive information-giving (e.g., "today I am going to paint your teeth with this tiny brush") and non-procedure talk (e.g., "have you had a good time at nursery today?"). Following child's increased level of engagement (e.g., chatted back and interacted with instruments); the lead nurse tried a variety of behaviours to coax the child to maintain his cooperation (e.g., praise, humour, instruction and gesture) until successful application.

3.5. Discriminant validity

Twenty-eight initially anxious children (78%) in NHS Fife were successful with the fluoride varnish application. Table 4 shows, after adjustment for duration of interaction, an increase by one instance in the use of "instruction" by a nurse pair was associated with a 32% increase in odds of being successful. And an additional "praise" (reinforcement of positive behaviour) was associated with

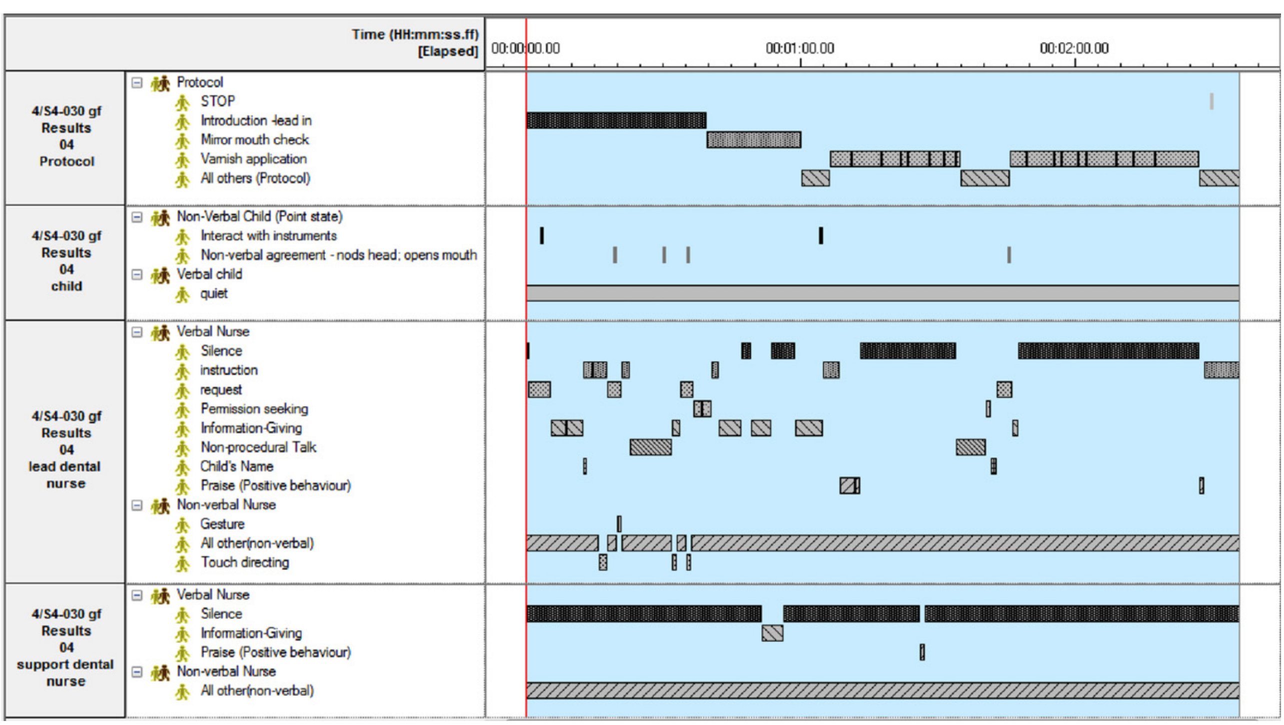


Fig. 3. An example of visualization of nurse–child interaction (2:29 min). *Notes*: Behavioural codes registered in an event log are plotted horizontally against a time axis. Each behaviour is originally plotted in its own colour in the system. The length of a horizontal bar indicates duration of a state event behaviour (e.g., non-procedural talk). The number of occurrence of a vertical segment indicates frequency of a point event behaviour (e.g., nodding head).

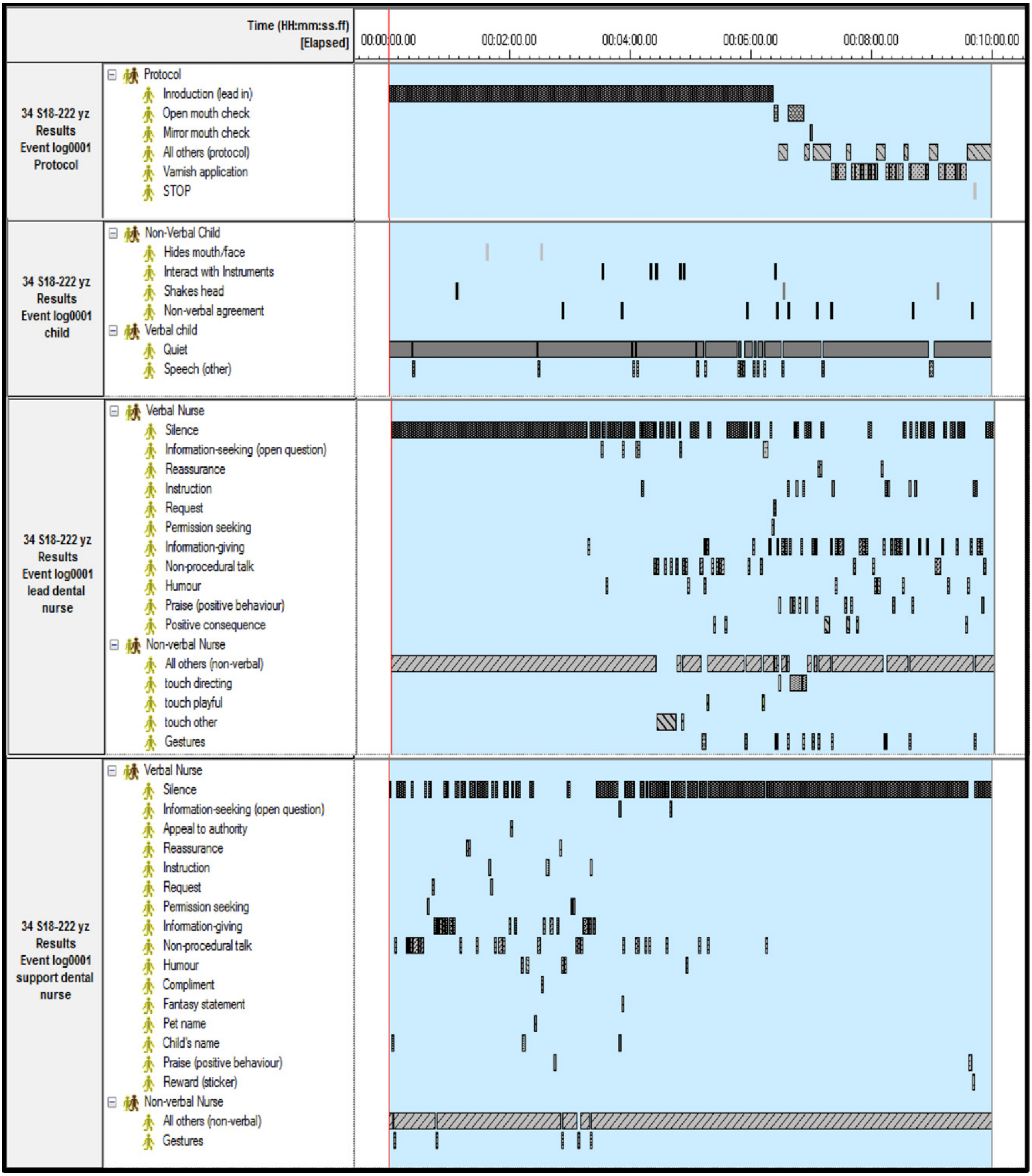


Fig. 4. Another example of nurse–child interaction (9:41 min).

Table 4
Adjusted[a] odds ratios for effects of the frequency of nurse pair behaviours on success of the fluoride varnish application in 36 nursery-school children.

Variable	Odds ratio	95% CI	*P* value
Instruction	1.32	1.03, 1.68	0.027
Praise	2.04	1.09, 3.84	0.027
Reward (sticker)	0.59	0.35, 1.00	0.050

[a] Each odds ratio is adjusted for duration of interaction.

over a twofold increase in odds of success of the fluoride varnish application. However, dental nurses' use of a sticker as a reward to motivate a child for an extra time was associated with a 41% reduction in odds of a child accepting the application.

4. Discussion and conclusions

4.1. Discussion

Paediatric dental professionals, especially those who work in a community, provide a rich repertoire of routine clinical behaviours, some of which may have positive and consistent effect on child cooperation. It is important to document these behaviours to help investigators to research child cooperativeness and for staff to appreciate the significance of their routine behaviour on treatment success. Developing a valid behavioural coding scheme is the first step to measure and investigate the clinical significance of these behaviours.

The SABICS was developed following a close observation of nurse–child interactions in a fluoride varnish intervention context in nursery schools. This scheme has demonstrated its capability of recording and displaying complex interaction processes with the video software system. The SABICS can be preferred to other available coding schemes (e.g., Weinstein et al. [9], Prins et al. [11]) in this clinical context as the number of discrete codes is more extensive and more explicitly defined. Satisfactory inter- and intra-coder reliability was found especially as the relatively large number of codes and the margin of temporal error was set at a single second criterion and will prejudice a high kappa value.

Three behavioural codes did discriminate between the children who accepted the varnish and those that did not. Approximately, a single behaviour only might be expected to approach statistical significance from the 11 behaviours entered into the logistic regression analysis. Of the three behaviours highlighted in the regressions, it was found that two had been recognized previously as important to encourage positive progress in children (Weinstein et al. [9]). The use of stickers by the nurses was believed to be another potential general reinforcer. However, when nurses were found to have offered a sticker it was associated with limiting acceptability of the fluoride varnish application. Behavioural analysis informs us that general reinforcement without a contingency to recently exhibited behaviour is very unlikely to show an association. Hence the dental nurses promising to offer a sticker in return for ''good'' behaviour was not associated in the direction predicted but indicated refusal of the application. It is possible that the dental nurses regarded the offer of a sticker as a method of regaining control of a child who exhibits no interest in receiving the varnish. The regression analysis provided some support for the appropriateness of the content of the behavioural profile in describing the interaction and ultimately predicting outcomes. Hence we believe analysing behaviours used routinely by paediatric dental staff, such as ''permission seeking'', ''instruction'' and ''praise'', will enhance our understanding of the effects of staff behaviour on child cooperation.

In order to capture the specific contextual features when studying the interaction between the nurses and the children in this health programme, the SABICS was preferred to other broader interaction coding schemes. Compared to the widely used Roter interaction analysis system [20], our SABICS demonstrated its strengths in the following ways. First, the duration of the ''turn'' and its behavioural code can be studied which is not the case with the RIAS. Second, the RIAS is mainly concerned with speech, and this is particularly evident with the definition that Roter uses for an ''utterance''. Our new scheme is dependent essentially on ''turn taking'', where the person being coded is reliant on who is taking the ''floor'' in the interaction. This is determined often through observation of non-verbal behaviour. Hence the SABICS focuses deliberately on both verbal and non-verbal behaviour. Third, ''silence'' and ''quiet'' are coded for both duration and frequency to reflect their roles in the analysis in the SABICS; while such codes are only scored as demarcation in communication in RIAS [21]. Furthermore, the RIAS system does not include ''crying'', a key behaviour required when observing and attempting to understand cooperative behaviour of young children. A further advantage of the detailed coding including behaviour duration and time-line information is that the sequence and timing of coded behaviours can be explicitly analysed.

In contrast to the high adaptability of the RIAS in varying medical contexts, caution is warranted, however, in applying the SABICS to other paediatric settings as some behavioural codes are context-specific. For example, use of ''fantasy statement'' (e.g., ''princess teeth'') might not work effectively with older children. We believe that, with minimal modification, it could be applied to the study of clinician–child behaviour in other clinical interventions (e.g. inoculations). Another possible limitation is that coding could be potentially time consuming particularly when conducting duration analysis where accuracy on time registration is crucial. In the example we described in this study, we chose to run through video clips seven separate times to increase coder reliability and analysis accuracy. It should be recognized that the majority of these clips were less than four minutes in length and the detailed duration data obtained were most suitable for sequential analysis purposes [22].

4.2. Conclusions

We developed a novel coding scheme for interactive behaviours between dental nurses and 3–5 years old children in a community based dental preventive care context. Implemented easily on The Observer XT system, the scheme is capable of recording and displaying complex interaction processes and demonstrates satisfactory inter- and intra-coder reliability. Compared to other broader interaction coding scheme, such as the RIAS, it has shown some strengths and limitations. The SABICS can be suitable for other paediatric settings when modified.

4.3. Practice implications

We believe that the SABICS scheme will assist researchers in the field of community paediatric interventions. Although context-specific, the scheme can be easily modified to be suitable for other paediatric contexts. In addition, the procedure described and tested in the present study for developing a novel coding scheme is useful for future studies in other paediatric settings.

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